SEQUENCE LISTING

<110> Kutchan, Toni M.
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Atkins, David G.
Fist, Anthony J.

<120> CODEINONE REDUCTASE FROM ALKALOID POPPY

<130> JJ-1825

<140> US 09/937,665
<141> 2001-09-26

<150> PCT/AU00/00249
<151> 2000-03-24

<150> AU PP 9463
<151> 1999-03-26

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<170> PatentIn version 3.2

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1 5

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Val Leu His Gln Ile Ala Val Ala Arg Gly Lys
1 5 10

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Asp Asp Asp Glu Leu Phe Ile Thr Ser Lys
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<213> Alfalfa

<400> 16

Lys Gln Gly Tyr Arg His Phe Asp Thr Ala Ala Ala Tyr Gly Ser Glu
1 5 10 15

Gln Ala Leu Gly Glu Ala Leu Lys Glu Ala Ile Glu Leu Gly Leu Val
20 25 30

Thr Arg Glu Glu Leu Phe Val Thr Ser Lys Leu Trp Val Thr Glu Asn
35 40 45

His Pro His Leu Val Ile Pro Ala Leu Gln Lys Ser Leu Lys Thr Leu
50 55 60

Gln Leu Asp Tyr Leu Asp Leu Tyr Leu Ile His Trp Pro Leu Ser Ser
65 70 75 80

Gln Pro Gly Lys Phe Ser Phe Pro Ile Asp Val Ala Asp Leu Leu Pro
85 90 95

Phe Asp Val Lys Gly Val Trp Glu Ser Met Glu Glu Ser Leu Lys Leu
100 105 110

Gly Leu Thr Lys Ala Ile Gly Val Ser Asn Phe Ser Val Lys Lys Leu
115 120 125

Glu Asn Leu Leu Ser Val Ala Thr Val Leu Pro Ala Val Asn Gln Val
130 135 140

Glu Met Asn Leu Ala Trp Gln Gln Lys Lys Leu Arg Glu Phe Cys Asn

145 150 155 160

Ala Asn Gly Ile Val Leu Thr Ala Phe Ser Pro Leu Arg Lys Gly Ala
165 170 175

Ser Arg Gly Pro Asn Glu Val Met Glu Asn Asp Met Leu Lys Glu Ile
180 185 190

Ala Asp Ala His Gly Lys Ser Val Ala Gln Ile Ser Leu Arg Trp Leu
195 200 205

Tyr Glu Gln Gly Val Thr Phe Val Pro Lys Ser Tyr Asp Lys Glu Arg
210 215 220

Met Asn Gln Asn Leu Cys
225 230

<210> 17
<211> 230
<212> PRT
<213> Glycyrrh

<400> 17

Lys Gln Gly Tyr Arg His Phe Asp Thr Ala Ala Ala Tyr Gly Ser Glu
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Thr Ala Leu Gly Glu Ala Leu Lys Glu Ala Arg Asp Leu Gly Leu Val
20 25 30

Thr Arg Glu Glu Leu Phe Val Thr Ser Lys Leu Trp Val Thr Glu Asn
35 40 45

His Pro His Leu Val Ile Pro Ala Leu Arg Lys Ser Leu Glu Thr Leu
50 55 60

Gln Leu Glu Tyr Leu Asp Leu Tyr Leu Ile His Trp Pro Leu Ser Ser
65 70 75 80

Gln Pro Gly Lys Phe Ser Phe Pro Ile Gln Val Glu Asp Leu Leu Pro
85 90 95

Phe Asp Val Lys Gly Val Trp Glu Ser Met Glu Glu Cys Leu Lys Leu
100 105 110

Gly Leu Thr Lys Ala Ile Gly Val Ser Asn Phe Ser Val Lys Lys Leu
115 120 125

Gln Asn Leu Leu Ser Val Ala Thr Ile Arg Pro Ala Val Val Gln Val
130 135 140

Glu Met Asn Leu Ala Trp Gln Gln Lys Lys Leu Arg Glu Phe Cys Thr
145 150 155 160

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Ala Asn Gly Ile Val Leu Thr Ala Phe Ser Pro Leu Arg Lys Gly Ala
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Ser Arg Gly Pro Asn Glu Val Met Glu Asn Asp Met Leu Lys Gly Ile
            180                 185                 190

Ala Glu Ala His Gly Lys Ser Ile Ala Gln Val Ser Leu Arg Trp Leu
        195                 200                 205

Tyr Glu Gln Gly Val Thr Phe Val Ala Lys Ser Tyr Asp Lys Glu Arg
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Met Asn Gln Asn Leu Gln
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<210> 18
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<213> Soybean

<400> 18

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Arg Ser Gln Asp Leu Phe Val Thr Ser Lys Leu Trp Val Thr Glu Asn
        35                  40                  45

His Pro His Leu Val Leu Pro Ala Leu Arg Lys Ser Leu Lys Thr Leu
    50                  55                  60

Gln Leu Glu Tyr Leu Asp Leu Tyr Leu Ile His Trp Pro Leu Ser Ser
65                  70                  75                  80

Gln Pro Gly Lys Phe Ser Phe Pro Ile Glu Val Glu Asp Leu Leu Pro
                85                  90                  95

Phe Asp Val Lys Gly Val Trp Glu Ser Met Glu Glu Cys Gln Lys Leu
            100                 105                 110

Gly Leu Thr Lys Ala Ile Gly Val Ser Asn Phe Ser Val Lys Lys Leu
        115                 120                 125

Gln Asn Leu Leu Ser Val Ala Thr Ile Arg Pro Val Val Asp Gln Val
    130                 135                 140

Glu Met Asn Leu Ala Trp Gln Gln Lys Lys Leu Arg Glu Phe Cys Lys
145                 150                 155                 160

Glu Asn Gly Ile Ile Val Thr Ala Phe Ser Pro Leu Arg Lys Gly Ala
                165                 170                 175
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Ser Arg Gly Pro Asn Glu Val Met Glu Asn Asp Val Leu Lys Glu Ile
180 185 190

Ala Glu Ala His Gly Lys Ser Ile Ala Gln Val Ser Leu Arg Trp Leu
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Tyr Glu Gln Gly Val Thr Phe Val Pro Lys Ser Tyr Asp Lys Glu Arg
210 215 220

Met Asn Gln Asn Leu His
225 230

<210> 19
<211> 44
<212> PRT
<213> Opium poppy

<400> 19

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Val Val Asn Gln Val Glu Met Ser Pro Thr Leu Val Leu His Gln Ile
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Ala Val Ala Arg Gly Lys Val Asn Glu Ile Pro Lys
35 40

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<213> Papaver somniferum

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ttttgaaagc gatagaggtc ggttacagac acttcgatac agctgctgca taccaaactg 180

aagagtgtct tggtgaagct atagctgaag cacttcaact tggtctaata aaatctcgag 240

atgaactctt catcacttcc aagctctggt gcgctgatgc tcacgctgat cttgtcctcc 300

ctgctcttca gaattctctg aggaatctta aattggacta tcttgatcta tatttgatac 360

accatccggt aagcttgaag ccagggaagt ttgttaacga aataccaaag gatcatatcc 420

ttccaatgga ctacaaatct gtatgggcag ccatggaaga gtgtcagacc cttggcttca 480

ctagggcaat cggggtctgt aatttctcat gcaaaaggct tcaagagttg atggaaacag 540

ccaacagccc tccagttgtg aatcaagtgg agatgagccc gactttacat caaaaaaatc 600

tgagggaata ttgcaaggcc aataatatca tgatcaccgc acactcagtt ttgggagccg 660

taggtgccgc ctggggcacc aatgcagtta tgcattctaa ggtgcttcac cagattgctg 720

tggccagagg aaaatctgtt gcccaggtta gtatgagatg ggtttaccag caaggcgcga 780

gtcttgtggt gaaaagtttc aatgaagcga ggatgaagga aaaccttaag atatttgatt 840

gggaactaac ggcagaagac atggaaaaga tcagtgagat tccacaatct agaacaagct 900

ctgctgcttt cttgttatca ccgactggac ctttcaaaac tgaagaagag ttctgggatg 960

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tttccctccg ttttg 1035

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aatgcgatag aggtcggtta cagacacttc gatacagctg ctgcatacca aagtgaagag 180

tgtcttggtg aagctatagc tgaagcactt caacttggtt taataaaatc tcgagatgaa 240

ctcttcatca cttccaagct ctggtgcgct gatgctcacg ctgatcttgt cctccctgct 300

cttcagaatt ctctgaggaa tctcaaattg gagtaccttg atctatattt gatacaccat 360

ccggtaagct tgaagccagg gaagcttgtt aacgaaatac caaaggatca tattcttcca 420

atggactaca aatctgtatg ggcagccatg gaagagtgtc agacccttgg cttcactagg 480

gcaatcggtg tcagtaattt ctcatgcaaa aagcttcaag agttgatggc aacagccaag 540

atccctccag ttgtgaatca agtggagatg agcccgactt tacatcaaaa aaatctgagg 600

gaatattgca aggccaataa tatcatgatc actgcacact cggttttggg agccataggt 660

gctccatggg gcagcaacgc agttatggat tctaaggtgc ttcaccagat tgctgtggca 720

agaggaaaat ctgttgccca ggttagtatg agatgggttt accagcaagg cgcgagtctt 780

gtggtgaaaa gtttcaatga agcgaggatg aaggaaaacc ttaagatatt tgattcggaa 840

ctaacggcag aagatatgga aaagatcagt gagattccgc aatctagaac aagctctgct 900

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gattga 966

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aaagcgatag aggtcggtta cagacacttc gatacagctg ctgcatacca aagtgaagag 180

tgtcttggtg aagctatagc tgaagcactt caacttggtc taataaaatc tcgagatgaa 240

ctcttcatca cttccaagct ctggtgcgct gatgctcacg ctgatcttgt cctccctgct 300

cttcagaatt ctctgaggaa tcttaaattg gactatcttg atctatattt gatacaccat 360

ccggtaagct tgaagccagg gaagtttgtt aacgaaatac caaaggatca tatccttcca 420

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gcaatcgggg tctgtaattt ctcatgcaaa aagcttcaag agttgatggc agcagccaag 540

atccctccag ttgtgaatca agtggagatg agcccgactt tacatcaaaa aaatctgagg 600

gaatattgca aggccaataa tatcatgatc actgcacact cggttttggg agccatatgt 660

gctccatggg gcagcaatgc agttatggat tctaaggtgc ttcaccagat tgctgtggca 720

agaggaaaat ctgttgccca ggttagtatg agatgggttt accagcaagg cgcgagtcta 780

gtggtgaaaa gtttcaatga agggaggatg aaggaaaacc ttaagatatt tgattgggaa 840

ctaacggcag agaatatgga aaagatcagt gagattccgc aatctagaac aagctctgct 900

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aaagcgatag aggtcggtta cagacacttc gatacagctg ctgcatacca aagtgaagag 180

tgtcttggtg aagctatagc tgaagcactt caacttggtt taataaaatc tcgagatgaa 240

ctcttcatca cttccaagct ctggtgcgct gatgctcacg ctgatcttgt cctccctgct 300

cttcagaatt ctctgaggaa tctcaaattg gagtatcttg atctatattt gatacaccat 360

ccggtaagct tgaagccagg gaaatttgtt aacgaaatac caaaggatca tattcttcca 420

atggactaca aatctgtatg ggcagccatg gaagagtgtc agacccttgg cttcactagg 480

gcaatcggtg tcagtaattt ctcatgcaaa aagcttcaag agttgatggc agcagccaag 540

atccctccag ttgtgaatca agtggagatg agccctactt tacatcaaaa aaatctgagg 600

gaatattgca aggccaataa tatcatgatc actgcacact cggttttggg agccataggt 660

gctccatggg gcagcaatgc agttatggat tctaaggtgc ttcaccagat tgctgtggca 720

agaggaaaat ctgttgccca ggttagtatg agatgggttt accagcaagg cgcgagtctt 780

gtggtgaaaa gtttcaatga agggaggatg aaggaaaacc ttaagatatt tgattgggaa 840

ctaacggcag aagatatgga aaagatcagt gagattccgc aatctagaac aagctctgct 900

gctttcttgt tatcaccgac tggacctttc aaaactgaag aagagttctg ggatgagaag 960

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caaggccaat aatatcatga tcactgcaca ctcggttttg ggagccatag gtgctccatg 120

gggcagcaat gcagttatgg attctaaggt gctt 154

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<212> DNA
<213> Papaver somniferum

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gggaagcttg ttaacgaaat accaaaggat catattcttc caatggacta caaatctgta 180

tgggcagcca tggaagagtg tcagaccctt ggcttcacta gggcaatcgg tgtcagtaat 240

ttctcatgca aaaagcttca agagttgatg gcaacagcca agatccctcc a 291